



Knowledge Management at IRMM

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IRMM - Institute for Reference Materials and Measurements

Geel - Belgium

<http://irmm.jrc.ec.europa.eu/>

<http://www.jrc.ec.europa.eu/>



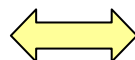
Mono-energetic neutron source

- 7 MV Van-de-Graaff accelerator
 - ${}^7\text{LiF}(p,n){}^7\text{Be}$, $\text{TiT}(p,n){}^3\text{He}$, $\text{D}_2(d,n){}^3\text{He}$, $\text{TiT}(d,n){}^4\text{He}$
 - DC ($I_{p,d} < 50 \mu\text{A}$), pulsed beam available
 - 4 + 1 non-T beam line
- $\Phi_n < 10^9 \text{ /s/sr}$
- *NEPTUNE* isomer spectrometer
- ionisation chambers, NE213 neutron/gamma-ray detectors, BF_3 counters, HPGe detectors
- Bonner spheres
- fast rabbit systems ($T_{1/2} > 1\text{s}$) for activation studies

GELINA neutron TOF spectrometer



- 70 - 140 MeV electron accelerator
- repetition frequency: 40 - 800 Hz
- neutron pulse: $2 \mu\text{s}$ - 1 ns @ FWHM
- $\Phi_n = 3.4 \cdot 10^{13}/\text{s}$ @ 800 Hz
- 12 different flight paths with a length between 8 and 400 m
- ionisation chambers, C_6D_6 detectors
- high-resolution γ -ray detectors
- fission chambers for flux monitoring

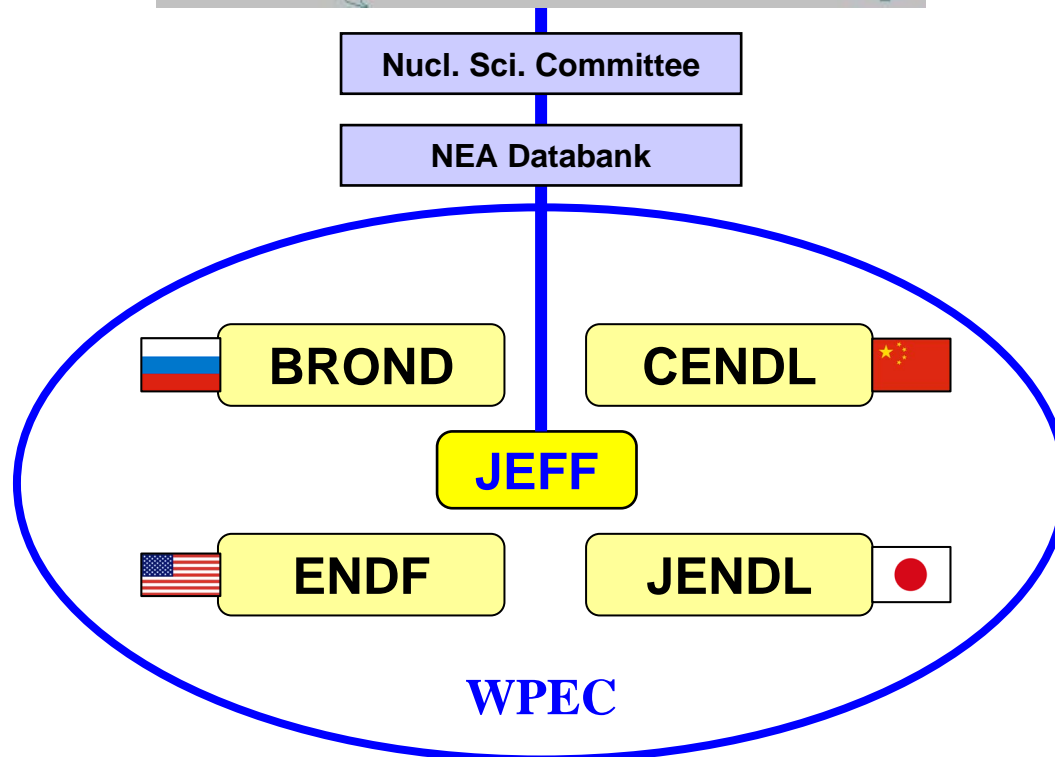


Nucl. Sci. Committee

NEA Databank

WPEC:
Working Party for
Evaluation Co-operation

JEFF:
Joint European
Fission + Fusion datafile



- **Neutron Data for Waste Transmutation and Safety of Different Reactor Systems (ADS, Generation IV, ...)**
 - **Basic Research in Nuclear Physics and Neutron Data Standards**
 - $^{10}\text{B}(n, \alpha) ^7\text{Li}$, $^{16}\text{O}(n, \alpha) ^{13}\text{C}$
 - Neutron-induced fission cross-sections
 - Fission-fragment characteristics as $Y(A, \text{TKE})$, v_p , $E_v(v)$
 - LCP emission, ...
- ⇒ **Improvement of nuclear cross-section data files**
- ⇒ **Precise input data for improved modelling of neutron-induced reactions**

Ingredients to knowledge management:

- **Collection, storage and preservation**
 - Nuclear data,
 - Measurement technologies
 - Data evaluation methods
 - Modelling
- **Dissemination of “achievements”**
 - Publications in refereed journals and conferences (specialized audience)
 - Vulgarization for general public distributed via (modern) media
- **Training of next generation**

Stakeholders/customers:

- **Institutes, R&D Organisations, Regulation bodies, Governmental Organisations**
- **Nuclear industries**
- **General public**
 - Nuclear safety
 - Long term waste management and safe storage

What/How Neutron Physics Unit is contributing at IRMM ?

Collection, storage and preservation

- **For neutron-induced reaction data**
 - Inventorying of critical measurement results (cross sections...)
 - Documentation of experimental methods/measurement techniques
 - Submission of documented data files to data evaluation bodies through the EXFOR data file maintained by the OECD-NEA

Dissemination of “achievements”

- Publication of results to relevant international journals => specialised audience (R&D organisations, industry, regulatory bodies...)
- Annual edition of the IRMM-NP Scientific Report publicly accessible via the IRMM external web-site
 - ⇒ Yearly update of achievements and entry point for customers
- Training material for users of the IRMM neutron sources (=> Training)
- Participation in the “Open Bedrijven Dag” (general public, media)
- ❖ Interesting could be a public JRC web-based platform for data and “knowledge” retrieval



- nuclear data measurements for waste
- transmutation and innovative reactor systems
- metrological tools for safeguards
- radionuclide metrology
- basic research in nuclear physics and standards



Training and Education at IRMM

- academic courses organised at IRMM
- academic courses given outside IRMM
- education of students as trainees
- education of PhD students

1. Academic courses organised at IRMM

Neutron time-of-flight experiments

- Master of Science in Nuclear Engineering program of the Belgian Nuclear higher Education Network (BNEN)
- elective advanced course
- two-days at GELINA lectures and hands-on experiments
- 2 ECTS
- 10 participants / course
- since 2004
- ENEN / NEPTUNO : <http://www.neptuno-cs.de>



1. Academic courses ...

Neutron measurements

- ERASMUS intensive program (IP) project:
Stimulation of Practical Expertise in Radiological and Nuclear Safety (SPERANSA)

Universidad Politecnica Valencia, Xios Hogeschool Hasselt, Politecnico Milano, ISIB Brussels, FH Aachen, Czech Technical University Praha
- two-days course at GELINA and Van de Graaff :
lectures and hands-on experiments on neutron data and flux measurements
- 35 participants / course
- since 2004





Institute for Reference
Materials and Measurements

The mission of the IRMM is to promote
a common and reliable European measurement system in
support of EU policies.

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SPERANSA training course Accelerators and neutron measurements

Programme

JRC-IRMM
Geel, Belgium

28-29 February 2008



Robust science for policy making

OUR MISSION

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the Joint Research Centre functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

1. Academic courses ...

Neutron flux measurements and radiation dosimetry (under discussion)

- on demand of academic network for Cooperation in Higher Education on Radiological and Nuclear Engineering (CHERNE)

14 European academic institutes (from Spain, Germany, Italy, Belgium, Czech republic and Portugal)

- 3 days course at GELINA and Van de Graaff
- hands-on experiments in the framework of a 14 days course on radiation dosimetry, radiation protection and nuclear measurements

2. Academic courses given outside IRMM

- **‘Nuclear Instrumentation’**
at University of Gent

6 ECTS course in Master of Physics, Master of Physical Engineering,
European Master in Nuclear Fusion Science and Engineering Physics (ERASMUS-MUNDUS)

- **‘Low-energy electron accelerators’**
at Joint Universities Accelerator School (Archamps, Geneva)

in framework of 10 weeks course in Particle Accelerator Physics and Technology
European network of 11 Universities of Science and Technology and CERN

- **‘Nuclear Data for activation analysis’**
- **‘Nuclear Reaction Data for advanced reactor technologies’**
ICTP (Trieste)
- **‘High-resolution cross section measurements’**
annual 3-hour lecture at BNEN (Mol)

3. Education of students as trainees

- **JRC traineeship**

- graduate students preparing a thesis
- post-graduate working experience

Academic year 2007 – 2008 :

- University of Milano
- University of Bologna
- University of Rome
- Örebrö University
- University of Vienna

Examples:

- mass spectrometry techniques in nuclear safeguards
- detector characterization

3. Education of ...

- bilateral collaboration agreements

University of Gent

Katholieke Hogeschool Kempen / University of Leuven

XIOS Nuclear Technologies of Hasselt / University of Brussels

→ graduate students preparing a thesis

2 to 4 students per academic year

Examples:

cross sections of Hf and W for astrophysics

characterization of reference materials

3. Education of ...

- **negotiation with University of Gent**

curriculum Master in Physics and Astronomy
Master in Physical Engineering



12 ECTS for 'mobility'
internships in research oriented organisation

- JRC traineeships
- bilateral agreement

4. Education of PhD students

- **PhD (Cat 20 / CA)**

Univ. Örebro (2)
IRI Delft
Univ. Sofia (2)
Univ. Bucharest (2)
Imperial college, London
Univ. Jyväskylä
Univ. Antwerp
Univ. Ljubljana
CEA Saclay
CEA Cadarache

- **PhD external, via coll. agreements**

CEA Cadarache
Univ. Gent (3), Delft,
Milano, Bologna, Birmingham

- **NUDAME Transnational Access Project**
→ **EUFRAT**

Examples

^{129}I capture and total cross-sections

^{233}Pa fission cross-sections

Low level Pu-measurements

Uranium reference particles

^{232}Th neutron capture cross-sections

Fission fragment properties for $^{238}\text{U}(\text{n},\text{f})$

Total and capture cross-sections of ^{241}Am

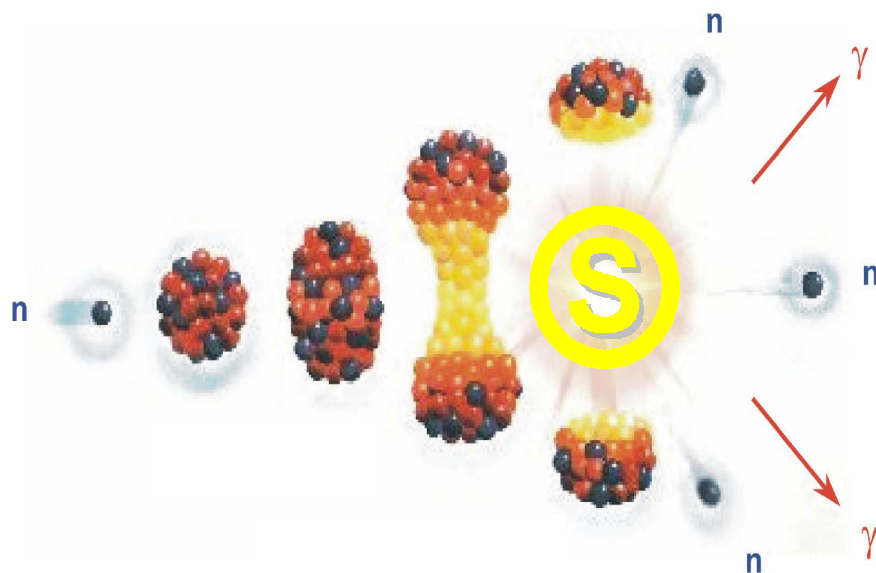
$^{239}\text{Pu}(\text{n},\text{f})$ at resonance energies

Tritium production via ternary fission

A compact fast-neutron producing target

New neutron-based isotopic analytical methods

+ Post-doc (Cat 30 / CA) → Training



Thank you for your attention ☺